LIQUID CRYSTAL DEVICE

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- European:	
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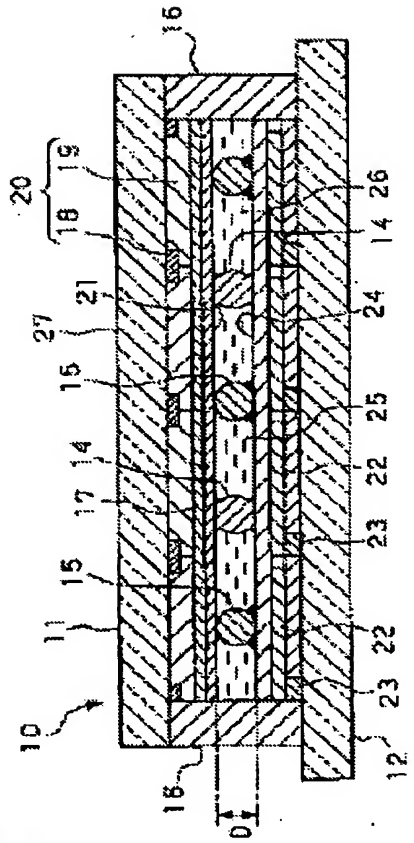
Abstract of **JP2001125111**

PROBLEM TO BE SOLVED: To obtain a liquid crystal device provided with film substrates in which deformation of substrates and generation of air bubbles in a cell due to temperature variation is suppressed even under low or high temperature and which is usable in a wide temperature range.
SOLUTION: In the liquid crystal device, a spacer 15 is adhered to a film substrate 12 and a substrate-connecting member 14 is connected with both of a film substrate 11 and the film substrate 12. Both the spacer 15 and the substrate-connecting member 14 are specified to have the coefficients of cubic expansion ranging 3× 10-4-1× 10-3/ deg.C.



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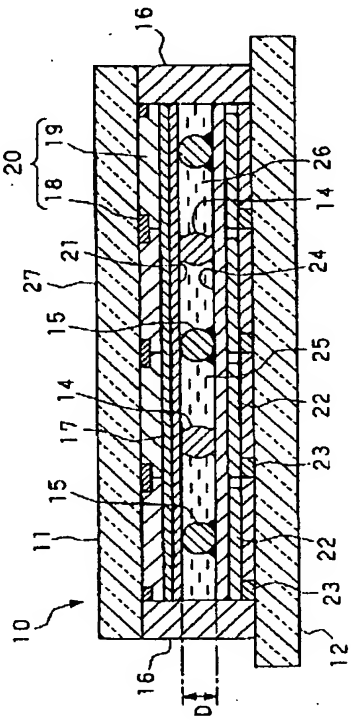
(54)【発明の名称】　液晶装置

(57)【要約】
【課題】　フィルム基板を有する液晶装置であって、低温時または高温時においても、温度変化によって生じる基板の変形やセル内の気泡の発生が抑制され、広い温度範囲で使用可能な液晶装置を得る。
【解決手段】　スペーサ１５がフィルム基板１２に接着され、基板連結部材１４がフィルム基板１１とフィルム基板１２の双方に連結され、前記スペーサ１５および基板連結部材１４の体膨張率がいずれも３×１０－４／℃～１×１０－３／℃の範囲内とされている。



【特許請求の範囲】
【請求項１】　少なくとも一方が可撓性である１対の基板が複数のスペーサを挟んで対向配置され、このスペーサにより規定された間隙に液晶が充填されてなる液晶装置であって、
前記スペーサは少なくともその一部が前記基板の少なくとも一方に接着され、
前記基板の間隙には前記スペーサとは別に基板相互を連結する基板連結部材が形成され、
前記スペーサおよび基板連結部材の体膨張率がいずれも３×１０－４／℃～１×１０－３／℃の範囲内であることを特徴とする液晶装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は液晶装置に関し、特に、１対の可撓性基板の間に特定範囲内の体膨張率を有する複数のスペーサおよび基板連結部材が介在する液晶装置に関する。
【０００２】
【従来の技術】図３は従来の液晶表示装置の一例を示す模式的な断面図である。図３においてこの液晶表示装置１００は、１対の可撓性透明プラスチック基板（以下、「フィルム基板」という）１１１および１１２が、その間に複数のスペーサ１１５…を挟んだ状態で周縁部をシール材１１６によって互いに接合され、このシール材１１６と双方のフィルム基板１１１，１１２とによって仕切られた枠内間隙（以下、「セル」という）１２６に液晶１２５が充填されてなっている。フィルム基板１１１，１１２の対向面にはそれぞれ、フィルム基板１１１側に透明導電膜からなる共通電極１１７など、フィルム基板１１２側に画素電極１２２などが形成されている。
【０００３】スペーサ１１５…は、前記セル１２６のセルギャップＤを規定し、かつ例えばフィルム基板１１１側から外部応力が加えられた場合にもこのセルのセルギャップＤが部分的に縮小しないように基板の間に均一に分散配置されるもので、基板表面への損傷防止、光漏れ軽減などの観点から粒径の揃った微小球体からなっている。このスペーサの材質としては、従来からポリスチレン樹脂、ジビニルベンゼン樹脂、メラミン樹脂、ベンゾグアナミン樹脂、シリカなどが用いられている。
【０００４】特にフィルム基板の液晶装置に用いられるスペーサ１１５は、この微小球体の表面に接着剤が塗布されていて、一方の基板上に散布し加熱するときその基板に接着し、セル内での移動が防止されている。
【０００５】また、特にフィルム基板の場合は表示面が可撓性であるため、湾曲や捻りが起こり易いので、前記スペーサ１１５とは別に、セル１２６内に基板相互を連結する基板連結部材１１４…が形成されている。この基板連結部材１１４は接着剤の球体からなり、一方の基板上に散布し、双方の基板で挟んで加熱するとき、双方の基板の内面に融着固化し、双方の基板を固定的に連結するようになっている。
【０００６】
【発明が解決しようとする課題】最近では液晶装置の適用分野が拡大しており、それに伴って例えば車載用や携帯電話機に使用されるものでは－３０℃～＋８０℃の広い温度範囲で使用し得るものが求められるようになってきている。このように広い可使温度範囲を有する液晶装置を設計する場合には、液晶とスペーサとの膨張率の差が問題になる。すなわち、一般に液晶の体膨張率は７×１０－４／℃程度であるのに対して従来用いられているスペーサの体膨張率は、材質がポリスチレン樹脂、ジビニルベンゼン樹脂、メラミン樹脂、ベンゾグアナミン樹脂など樹脂系の場合にいずれも３×１０－４／℃未満であり、シリカ系では１．５×１０－５／℃程度であって、液晶の膨張率に比べてかなり低い。そこで、セル内に常温で充填された液晶１２５は、低温時にはスペーサ１１５…の粒径が縮小したことによって収縮したセル１２６の容積より更に液晶１２５の体積が減少することになり、その結果、セル１２６のセルギャップＤが部分的に不均一になったり、セル１２６内にキャビティまたは気泡が発生するなどの問題が起こる。
【０００７】この膨張率の差による障害を回避するために、従来の液晶装置においては、例えばセルの周囲に液晶が流通し得る予備室を設けて温度変化に応じてセルの容積と液晶の体積との差を調整したり、直径が異なるスペーサを混在させたり、液晶装置の表示面にのみスペーサを散布するなどの工夫がなされている。しかしこれらは、液晶装置の小型化の障害になったり、大きい温度変化に対して十分に効果が得られなかったり、加工処理が煩雑または困難であったりして、いずれも好ましい方法ではなかった。特に低温域における気泡発生の問題やセルギャップが部分的に不均一になる問題に対して、前記方法では満足できる効果が得られなかった。
【０００８】本発明は前記の課題を解決すべく鋭意研究の結果達成されたものであって、従ってその目的は、少なくとも一方がフィルム基板である液晶装置において、温度変化によって生じるフィルム基板の変形やセル内の気泡の発生を抑制し、広い温度範囲で使用可能な液晶装置を提供することにある。
【０００９】
【課題を解決するための手段】前記の課題を解決するために本発明は、少なくとも一方が可撓性である１対の基板が複数のスペーサを挟んで対向配置され、このスペーサにより規定された間隙に液晶が充填されてなる液晶装置であって、前記スペーサは少なくともその一部が前記基板の少なくとも一方に接着され、前記基板の間隙には前記スペーサとは別に基板相互を連結する基板連結部材が形成され、前記スペーサおよび基板連結部材の体膨張率がいずれも３×１０－４／℃～１×１０－３／℃の範

囲内である液晶装置を提供する。

【0010】本発明の前記液晶装置において、スペーサおよび基板連結部材の体膨張率はいずれも、約7×10−4／℃である液晶の体膨張率と同等または近似しているので、環境温度が変化しても、スペーサにより規定されたセルの容積とセル内に含まれる液晶の体積とが同程度に膨張または収縮し、この結果、高温時における液晶の相対的な過膨張によるフィルム基板の変形や低温時における液晶の相対的な過収縮によるセル内の気泡の発生やセルギャップの部分的な不均一が抑制され、広い温度範囲で実用可能な液晶装置が得られる。

【0011】環境温度の更に広範な変化に対応するには、スペーサおよび基板連結部材の体膨張率をできるだけ液晶の体膨張率に近づけることが望ましく、この観点から、スペーサおよび基板連結部材の体膨張率は4×10−4／℃～9×10−4／℃の範囲内とすることが好ましい。

【0012】前記において、スペーサおよび基板連結部材の体膨張率が3×10−4／℃未満では、液晶の体膨張率との差が大きすぎて、高温時または低温時にセルの容積とセルに含まれる液晶の体積との差が拡大し、高温時の基板の変形や低温時の気泡の発生やセルギャップの部分的な不均一を抑制することが困難になる。またスペーサおよび基板連結部材の体膨張率が1×10−3／℃を越えると、逆に高温時にセルの容積が液晶の体積より過大となってセル内に気泡が発生したり、低温時に基板連結部材の長さが過小になって基板との連結部が破壊されたり基板の平面性が損なわれたりする可能性があり、また一般に体膨張率が1×10−3／℃を越える素材は常温では軟質または流体であってスペーサとして基板を支持し得ない場合もあり好ましくない。

【0013】前記においてスペーサの少なくとも一部は、基板の少なくとも一方に接着されているので、基板とスペーサとの間に僅かな隙間が生じてもスペーサがセル内を移動することなく好適な分布状態が維持される。また基板連結部材が設けられているので、液晶装置の表示面が外力によって湾曲されても、対向する基板がずれて例えば対向する電極の相対位置が狂うということはない。

【0014】本発明の液晶装置において、1対の基板の少なくとも一方は透明基板である。一方が透明基板であれば反射型液晶装置となり、双方が透明基板であれば透過型液晶装置となる。また1対の基板の双方がフィルム基板であってもよく、一方がフィルム基板で他方は例えばガラス基板などの硬質基板であってもよい。

【0015】

【発明の実施の形態】以下、本発明の実施の形態を具体例により図面を用いて説明する。

【0016】図1は本発明に従う液晶表示装置の模式的な断面図である。図1においてこの液晶装置10は、フィルム基板11とフィルム基板12とが、その間に複数のスペーサ15…を挟んだ状態で周縁部をシール材16によって互いに対向配置され接合されている。一方のフィルム基板11の対向面には順次に、例えばITO（インジウムすず酸化物）などの透明導電膜からなるパターン形成されたコモン電極17と、液晶を配向させる配向膜21とが形成されている。また他方のフィルム基板12の対向面には、例えばITOからなる前記コモン電極17と直交するようにパターン形成されたセグメント電極22…と、前記セグメント電極22の上に形成され液晶を配向させるための配向膜24とが形成されている。

【0017】フィルム基板11，12とシール材16とによって仕切られたセル（枠内間隙）26内には、前記スペーサ15…とは別に、基板相互を連結する基板連結部材14…が形成されている。またこのセル26内には液晶25が充填されて、配向膜21，24によって一定のモードに配向されている。更にこの液晶表示装置は、図示しないが、光源、偏光板、位相差板、反射防止膜などの光学的手段を備えている。

【0018】スペーサ15…は、平均粒径が6．30μmの粒径の揃った微小球体であり、材質がポリアミド610（ポリヘキサメチレンセバカミド）からなるスペーサ本体の表面に感熱性接着剤が塗布され、フィルム基板12上に均一に散布された後、加熱によってフィルム基板12の表面に接合されている。

【0019】基板連結部材14…は、本体がスペーサ15と同様な平均粒径が6．30μmのポリアミド610からなる微小球体であり、この表面に、前記スペーサ15に用いたものより低温度で融着する感熱性接着剤が塗布され、フィルム基板12上に均一に散布され、フィルム基板11が重ねられた後、炉中で前記接着剤の融着温度に加熱され、フィルム基板11および12の双方に融着固定されている。

【0020】スペーサ15および基板連結部材14の体膨張率はいずれも4．0×10−4／℃である。そしてフィルム基板11とフィルム基板12とは、これらのスペーサ15…および基板連結部材14…によって室温で6．30μm 隔てられている。すなわち、セル26の厚みDは6．30μm である。

【0021】この液晶表示装置は、パターン形成されたセグメント電極22とパターン形成されたコモン電極17との間に電位が印加されると、配向膜21，24によって一定のモードに配向されていた液晶分子が配向モードを変化させ、これによって、液晶装置10の表示面27を透過する光を制御することができる。

【0022】この液晶表示装置は、セル26にスペーサ15…および基板連結部材14…が介在しているので、柔軟なフィルム基板11に外部応力が加えられてもセルが圧迫されて厚みDを減じ液晶の配向を乱すことがない。

【００２３】更にこの液晶表示装置は、スペーサ１５および基板連結部材１４の体膨張率が共に液晶の体膨張率に近似する３／１０－４／℃～１×１０－３／℃の範囲内、特に好ましい範囲である４／１０－４／℃～９×１０－４／℃内にあるので、液晶の可使温度範囲内ではスペーサ１５により規定されたセル２６の容積とセルに含まれる液晶２５の体積とが温度の高低に係わらずほぼ等しく維持され、この結果、高温時における液晶の相対的な過膨張によるフィルム基板の変形や低温時における液晶の相対的な過収縮によるセル内の気泡の発生が抑制され、広い温度範囲で使用可能な液晶装置が得られる。

【００２４】また、この液晶表示装置は、セル２６の厚みを支えるスペーサが球形を維持しているスペーサ１５と、双方のフィルム基板１１，１２に強固に接合した基板連結部材１４とからなっているので、表示面２７の開口率を損なうことなく、外部応力に抗してセルの厚みＤを常に一定に維持することができる。

【００２５】前記具体例ではスペーサ１５および基板連結部材１４としていずれもポリアミド６１０からなるものを用いたが、要はスペーサの体膨張率が３×１０－４／℃～１×１０－３／℃の範囲内、好ましくは４×１０－４／℃～９×１０－４／℃の範囲内にあればよいのであるから、前記の材質に限定されるものではなく、またスペーサ１５および基板連結部材１４の材質はそれぞれ同じでも異なっていてもよい。

【００２６】スペーサおよび基板連結部材の材質の他の具体例としては、例えば体膨張率が前記範囲内に調整されたポリアミド６６（ポリヘキサメチレンアジパミド）、ポリアミド１１（ポリウンデカナミド）、ニトロセルロース、アセチルセルロース、ポリブチレン、ポリ－４－メチルペンテン－１、ポリビニルホルマール、ポリビニルアセタール、ポリビニルブチラール、塩化ビニリデン、ポリアセタール、およびこれらの共重合物または架橋物、および脂肪族アミン架橋エポキシ樹脂などを挙げることができる。

【００２７】本発明の液晶装置は前記の液晶表示装置に限定されるものではない。少なくとも一方が可撓性である１対の基板の間にスペーサと基板連結部材とが介在し、このスペーサおよび基板連結部材の体膨張率がいずれも前記範囲内にある液晶装置は、透過型液晶装置であっても反射型液晶装置であっても、またアクティブマトリクス型液晶装置、セグメント型液晶装置、光アドレス型液晶装置、熱アドレス型液晶装置などのいずれであっても全て本発明に含まれるものである。本発明の液晶装置は、例えばワードプロセッサ、コンピュータディスプレイ、液晶テレビジョン、ビデオカメラ、ビデオテープレコーダ、電子手帳、電子卓上計算機、カーナビゲーション装置、大型表示板、ＰＯＳ端末機、タッチパネル付き入力装置、オーディオ機器、各種計器板、液晶プロジェクタ（液晶装置を用いた投射型表示装置）、携帯電話機、腕時計、腕時計型電子機器、各種測定機器などの分野で表示装置として広く適用することができる。特に実使用時に過酷な可使温度範囲が要求される車載用機器、航空機用機器、携帯電話機などの表示装置として有利に使用することができる。更に本発明の液晶装置は、表示装置以外にも、例えば光シャッタ装置や偏光装置などの分野にも適用することができる。

【００２８】本発明の液晶装置を表示装置として用いた電子機器の具体例を図２（ａ）（ｂ）（ｃ）に示す。

【００２９】図２（ａ）は携帯電話の一例を示した斜視図である。図２（ａ）において、２００は携帯電話本体を示し、２０１は本発明の液晶装置を用いた液晶表示部を示している。

【００３０】図２（ｂ）はワードプロセッサ、パーソナルコンピュータなどの携帯型情報処理装置の一例を示した斜視図である。図２（ｂ）において、３００は情報処理装置、３０１はキーボードなどの入力部、３０３は情報処理本体、３０２は本発明の液晶装置を用いた液晶表示部を示している。

【００３１】図２（ｃ）は腕時計型電子機器の一例を示した斜視図である。図２（ｃ）において、４００は時計本体を示し、４０１は本発明の液晶装置を用いた液晶表示部を示している。

【００３２】図２（ａ）～図２（ｃ）に示すそれぞれの電子機器は、本発明の液晶装置のいずれかを用いた液晶表示部を備えたものであるので、低温時または高温時においても温度変化によって生じる基板の変形やセル内の気泡の発生が抑制され、広い温度範囲で使用可能となる。

【００３３】

【発明の効果】本発明の液晶装置は、少なくとも一方が可撓性である１対の基板の間に介在するスペーサおよび基板連結部材の体膨張率がいずれも３×１０－４／℃～１×１０－３／℃の範囲内であるので、低温時または高温時においても温度変化によって生じる基板の変形やセル内の気泡の発生が抑制され、広い温度範囲で使用可能となる。

【図面の簡単な説明】

【図１】　本発明の液晶装置の一例を示す模式的な断面図である。

【図２】　（ａ）（ｂ）（ｃ）はそれぞれ本発明の液晶装置を用いた液晶表示部を有する電子機器の例を示す斜視図である。

【図３】　従来の液晶装置の一例を示す模式的な断面図である。

【符号の説明】

１０：液晶装置

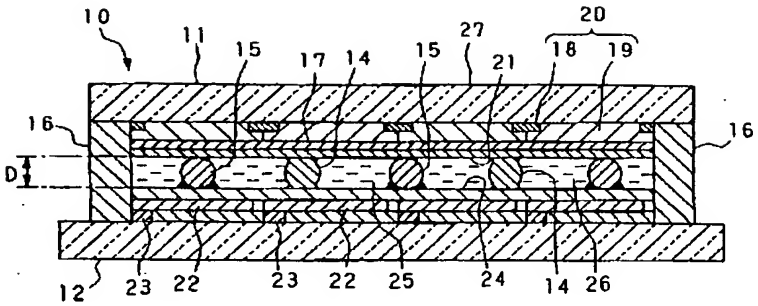
１１，１２：フィルム基板

１４：基板連結部材

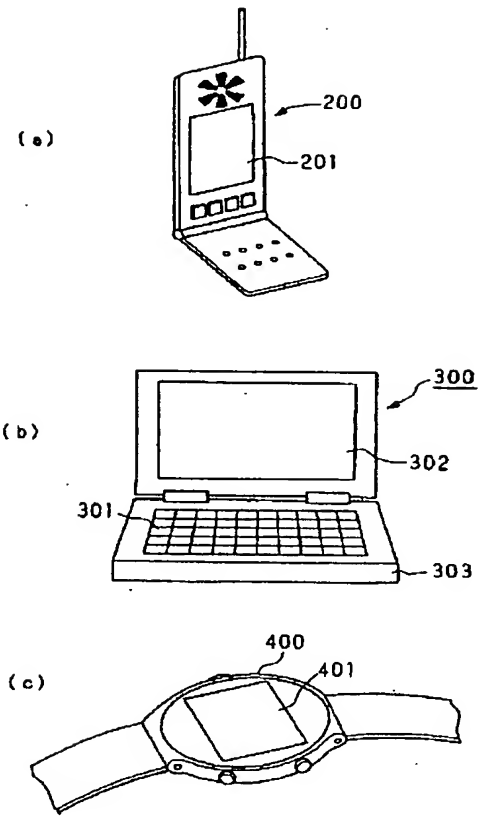
１５：スペーサ

16：シール材
17：コモン電極
20：光学層
21，24：配向膜
22：セグメント電極
25：液晶
26：セル

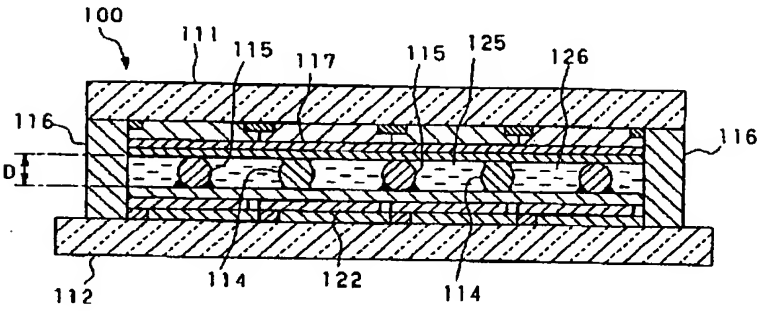
【図1】



【図2】



【図3】



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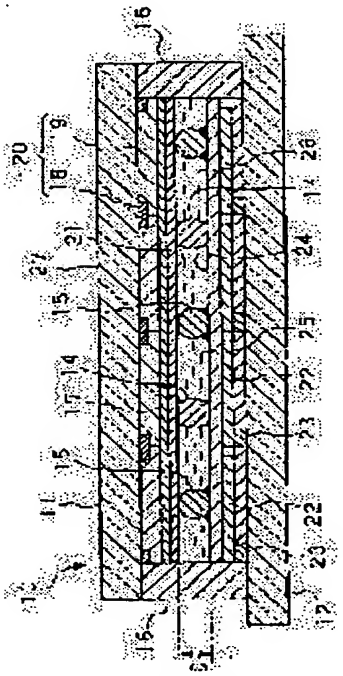
(72)Inventor : IMAI SHUICHI

(54) LIQUID CRYSTAL DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a liquid crystal device provided with film substrates in which deformation of substrates and generation of air bubbles in a cell due to temperature variation is suppressed even under low or high temperature and which is usable in a wide temperature range.
SOLUTION: In the liquid crystal device, a spacer 15 is adhered to a film substrate 12 and a substrate-connecting member 14 is connected with both of a film substrate 11 and the film substrate 12. Both the spacer 15 and the substrate-connecting member 14 are specified to have the coefficients of cubic expansion ranging 3×10-4-1×10-3/° C.



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[Date of extinction of right]	

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CLAIMS

[Claim(s)]
[Claim 1] On both sides of two or more spacers, opposite arrangement of one pair of substrates at least whose one side is flexibility is carried out. It is liquid crystal equipment with which it comes to fill [liquid crystal] up the gap specified by this spacer. The part pastes up said spacer at least on one side of said substrate at least. Liquid crystal equipment which the substrate connection member which connects both substrates apart from said spacer is formed in the gap of said substrate, and is characterized by each coefficient of cubic expansion of said spacer and a substrate connection member being within the limits of 3x10-4/degree-C - 1x10-3/degree C.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the liquid crystal equipment with which two or more spacers and substrate connection members which have the coefficient of cubic expansion of specific within the limits intervene between one pair of flexible substrates about liquid crystal equipment.
[0002]
[Description of the Prior Art] Drawing 3 is the typical sectional view showing an example of the conventional liquid crystal display. It sets to drawing 3 , this liquid crystal display 100 of each other is joined by the sealant 116 in the periphery section, after one pair of flexible transparence plastic plates (henceforth a "film substrate") 111 and 112 have inserted two or more spacer 115 — into the meantime, and it has come to fill [liquid crystal 125] up the within the limit gap (henceforth a "cel") 126 divided by this sealant 116 and both film substrates 111,112. The pixel electrode 122 etc. is formed in the film substrates 112 side, such as the common electrode 117 which becomes the opposed face of the film substrate 111,112 from the transparence electric conduction film at the film substrate 111 side, respectively.
[0003] Also when the cel gap D of said cel 126 is specified and external force is applied for example, from the film substrate 111 side, spacer 115 — is distributed by homogeneity between substrates so that the cel gap D of this cel may not contract partially, and it consists of a microsphere to which particle size was equal from viewpoints, such as damage prevention to a substrate front face, and optical leakage mitigation. As the quality of the material of this spacer, polystyrene resin, divinylbenzene resin, melamine resin, benzoguanamine resin, a silica, etc. are used from the former.
[0004] Adhesives are applied to the front face of this microsphere, especially the spacer 115 used for the liquid crystal equipment of a film substrate is pasted up on that substrate, when sprinkling and heating on one substrate, and migration within a cel is prevented.
[0005] Moreover, since the screen is flexibility especially in the case of a film substrate and a curve and a twist tend to take place, substrate connection member 114 — which connects both substrates is formed in the cel 126 independently [said spacer 115]. This substrate connection member 114 consists of a solid sphere of adhesives, is sprinkled on one substrate, when inserting and heating with both substrates, carries out welding solidification and connects both substrates with the inside of both substrates fixed.
[0006]
[Problem(s) to be Solved by the Invention] Recently, Field of application of liquid crystal equipment is expanded, and what can be used in a -30 degrees C - +80 degrees C large temperature requirement is increasingly called for in what is used for the object for mount, or a portable telephone in connection with it. Thus, in designing the liquid crystal equipment which has a large working temperature range, the difference of the expansion coefficient of liquid crystal and a spacer becomes a problem. That is, generally, in the case of a resin system, such as polystyrene resin, divinylbenzene resin, melamine resin, and benzoguanamine resin, each is less than [3x10-4/degree C], and the quality of the material is about 1.5x10-5/degree C, and is

quite low [the coefficient of cubic expansion of the spacer conventionally used to the coefficient of cubic expansion of liquid crystal being about 7x10-4/degree C] by the silica system, compared with the expansion coefficient of liquid crystal. Then, the volume of liquid crystal 125 will decrease further from the volume of the cel 126 which contracted the liquid crystal 125 filled up with ordinary temperature in the cel at the time of low temperature when [of spacer 115 —] particle size contracted, consequently the cel gap D of a cel 126 becomes an ununiformity partially, or the problem of a cavity or air bubbles being generated in a cel 126 arises.
[0007] In order to avoid the failure by the difference of this expansion coefficient, in conventional liquid crystal equipment, the spare room where liquid crystal may circulate is established, for example in the perimeter of a cel, according to the temperature change, adjust the difference of the volume of a cel, and the volume of liquid crystal, the spacer with which diameters differ is made intermingled, or the device of sprinkling a spacer only to the screen of liquid crystal equipment is made. However, and to the large temperature change, effectiveness was not fully acquired, or processing processing was complicated or difficult for these, and neither was a desirable approach. [becoming the failure of a miniaturization of liquid crystal equipment] The effectiveness can be satisfied with said approach of effectiveness was not acquired to the problem of gassing especially in a low-temperature region, or the problem from which a cel gap becomes an ununiformity partially.
[0008] This invention is wholeheartedly attained as a result of research that the aforementioned technical problem should be solved, therefore in the liquid crystal equipment at least whose one side is a film substrate, the purpose controls deformation of the film substrate produced by the temperature change, and generating of the air bubbles in a cel, and is to offer usable liquid crystal equipment in a large temperature requirement.
[0009]
[Means for Solving the Problem] In order to solve the aforementioned technical problem, opposite arrangement of this invention is carried out on both sides of the spacer of plurality [substrates / one pair of / at least whose one side is flexibility]. It is liquid crystal equipment with which it comes to fill [liquid crystal] up the gap specified by this spacer. The part pastes up said spacer at least on one side of said substrate at least. The substrate connection member which connects both substrates apart from said spacer is formed in the gap of said substrate, and the liquid crystal equipment each whose coefficient of cubic expansion of said spacer and a substrate connection member is within the limits of 3x10-4/degree-C - 1x10-3/degree C is offered.
[0010] said liquid crystal equipment of this invention — setting — the coefficient of cubic expansion of a spacer and a substrate connection member — each — about — equivalent to the coefficient of cubic expansion of the liquid crystal which is 7x10-4/degree C — or, since it approximates Even if environmental temperature changes, the volume of the cel specified by the spacer and the volume of the liquid crystal contained in a cel expand or contract to the same extent. Consequently, the partial ununiformity of generating of the air bubbles in the cel by relative fault contraction of deformation of the film substrate by the relative overexpansion of the liquid crystal at the time of an elevated temperature or the liquid crystal at the time of low temperature or a cel gap is controlled, and liquid crystal equipment usable in a large temperature requirement is obtained.
[0011] In order to correspond to a still more extensive change of environmental temperature, it is desirable to bring the coefficient of cubic expansion of a spacer and a substrate connection member close to the coefficient of cubic expansion of liquid crystal as much as possible, and, as for the coefficient of cubic expansion of this viewpoint to a spacer and a substrate connection member, it is desirable to consider as within the limits of 4x10-4/degree-C - 9x10-4/degree C.
[0012] In the above, a difference with the volume of liquid crystal which a difference with the coefficient of cubic expansion of liquid crystal has a too large coefficient of cubic expansion of a spacer and a substrate connection member less than [3x10-4/degree C], and is contained in the volume of a cel and a cel at the time of an elevated temperature or low temperature is expanded, and it becomes difficult to control the partial ununiformity of generating of

deformation of the substrate at the time of an elevated temperature and the air bubbles at the time of low temperature or a cel gap. Moreover, if the coefficient of cubic expansion of a spacer and a substrate connection member exceeds 1x10-3/degree C The volume of a cel becomes more excessive than the volume of liquid crystal at the time of an elevated temperature. Conversely, air bubbles are generated in a cel or The die length of a substrate connection member becomes [too little] at the time of low temperature, the connection section with a substrate may be destroyed or smoothness of a substrate may be spoiled. Moreover, the material with which coefficient of cubic expansion generally exceeds 1x10-3/degree C is elasticity or a fluid in ordinary temperature, and supports a substrate as a spacer and is not desirable.

[0013] Since some spacers [at least] are pasted up at least on one side of a substrate in the above, a suitable distribution condition is maintained without a spacer moving in the inside of a cel, even if few clearances are generated between a substrate and a spacer. Moreover, since the substrate connection member is prepared, even if the screen of liquid crystal equipment curves according to external force, the relative position of the electrode which the substrate which counters shifts, for example, counters is not necessarily out of order.

[0014] In the liquid crystal equipment of this invention, at least one side of one pair of substrates is a transparence substrate. If one side is a transparence substrate, it will become high-reflective-liquid-crystal equipment, and if both sides are transparence substrates, it will become transparency mold liquid crystal equipment. Moreover, the both sides of one pair of substrates may be film substrates, and one side of another side may be hard substrates, such as a glass substrate, in a film substrate.

[0015]

[Embodiment of the Invention] Hereafter, an example explains the gestalt of operation of this invention using a drawing.

[0016] Drawing 1 is the typical sectional view of the liquid crystal display according to this invention. It sets to drawing 1 , and where two or more spacer 15 -- is inserted into the meantime, opposite arrangement of the film substrate 11 and the film substrate 12 of each other is carried out by the sealant 16 in the periphery section, and this liquid crystal equipment 10 is joined. The common electrode 17 which consists of transparence electric conduction film, such as ITO (indium tin oxide), and by which pattern formation was carried out, and the orientation film 21 to which orientation of the liquid crystal is carried out are formed in the opposed face of one film substrate 11 one by one. Moreover, segment electrode 22 -- by which pattern formation was carried out so that it might intersect perpendicularly with said common electrode 17 which consists of ITO, and the orientation film 24 for being formed on said segment electrode 22 and carrying out orientation of the liquid crystal are formed in the opposed face of the film substrate 12 of another side.

[0017] In the cel (within the limit gap) 26 divided by the film substrates 11 and 12 and the sealant 16, substrate connection member 14 -- with which said spacer 15 -- connects both substrates independently is formed. Moreover, it fills up with liquid crystal 25 in this cel 26, and orientation is carried out to the fixed mode with the orientation film 21 and 24. Furthermore, although this liquid crystal display is not illustrated, it is equipped with the optical means of the light source, a polarizing plate, a phase contrast plate, an antireflection film, etc.

[0018] For spacer 15 --, mean particle diameter is 6.30 micrometers. It is the microsphere to which particle size was equal, and after thermosensitive adhesives are applied to the front face of the body of a spacer with which the quality of the material consists of a polyamide 610 (polyhexamethylene sebacamide) and being sprinkled by homogeneity on the film substrate 12, it is joined to the front face of the film substrate 12 by heating.

[0019] A body is a microsphere which consists of a polyamide 610 the same mean particle diameter of whose as a spacer 15 is 6.30 micrometers, after the thermosensitive adhesives welded by whenever [low-temperature] from what was used for said spacer 15 are applied, substrate connection member 14 -- is sprinkled by homogeneity on the film substrate 12 and the film substrate 11 puts it on this front face, it is heated by the welding temperature of said adhesives all over a furnace, and welding immobilization is carried out to the both sides of the

film substrates 11 and 12.

[0020] Each coefficient of cubic expansion of a spacer 15 and the substrate connection member 14 is 4.0x10-4/degree C. And the film substrate 11 and the film substrate 12 are 6.30 micrometers at a room temperature by these spacer 15 -- and substrate connection member 14--. It is separated. namely, thickness D of a cel 26 -- 6.30 micrometers it is .

[0021] The liquid crystal molecule by which orientation of this liquid crystal display was carried out to the fixed mode with the orientation film 21 and 24 when potential was impressed between the segment electrode 22 by which pattern formation was carried out, and the common electrode 17 by which pattern formation was carried out can change orientation mode, and the light which penetrates the screen 27 of liquid crystal equipment 10 can be controlled by this.

[0022] Since it is placed between cels 26 by spacer 15 -- and substrate connection member 14--, even if external force is applied to the flexible film substrate 11, a cel is pressed, and this liquid crystal display reduces thickness D, and does not disturb the orientation of liquid crystal.

[0023] Furthermore, within the limits of 3x10-4/degree-C [to which the coefficient of cubic expansion of a spacer 15 and the substrate connection member 14 approximates this liquid crystal display both to the coefficient of cubic expansion of liquid crystal] - 1x10-3/degree C, 4x10-4/degree-C [which is the especially desirable range] - 9x10-4/degree C, since it is inside The volume of the cel 26 specified by the spacer 15 within the working temperature range of liquid crystal and the volume of the liquid crystal 25 contained in a cel are maintained almost equally irrespective of the height of temperature. Consequently, deformation of the film substrate by the relative overexpansion of the liquid crystal at the time of an elevated temperature and generating of the air bubbles in the cel by relative fault contraction of the liquid crystal at the time of low temperature are controlled, and usable liquid crystal equipment is obtained in a large temperature requirement.

[0024] Moreover, without spoiling the numerical aperture of the screen 27, since the spacer supporting the thickness of a cel 26 consists of a spacer 15 which is maintaining the globular form, and a substrate connection member 14 firmly joined to both film substrates 11 and 12, this liquid crystal display can resist external force, and can always maintain thickness D of a cel uniformly.

[0025] Although what all consists of a polyamide 610 as a spacer 15 and a substrate connection member 14 was used by said example In short, within the limits whose coefficient of cubic expansion of a spacer is 3x10-4/degree-C - 1x10-3/degree C, since what is necessary is just to be within the limits of 4x10-4/degree-C - 9x10-4/degree C preferably, it is not what is limited to the aforementioned quality of the material. moreover, even if the quality of the material of a spacer 15 and the substrate connection member 14 is the same respectively, they may differ.

[0026] As other examples of the quality of the material of a spacer and a substrate connection member, coefficient of cubic expansion can mention the polyamide 66 (polyhexamethylene adipamide) adjusted to said within the limits, a polyamide 11 (poly undeca NAMIDO), a nitrocellulose, an acetyl cellulose, polybutylene, the Polly 4-methyl pentene -1, a polyvinyl formal, a polyvinyl acetal, a polyvinyl butyral, a vinylidene chloride, polyacetals and these copolymerization objects or a bridge formation object, a fatty amine bridge formation epoxy resin, etc., for example.

[0027] The liquid crystal equipment of this invention is not limited to the aforementioned liquid crystal display. A spacer and a substrate connection member intervene between one pair of substrates at least whose one side is flexibility, and whether it is high-reflective-liquid-crystal equipment even if it is transparency mold liquid crystal equipment, or the liquid crystal equipment which has each coefficient of cubic expansion of this spacer and a substrate connection member in said within the limits is any, such as active matrix liquid crystal equipment, segmental-die liquid crystal equipment, optical address type liquid crystal equipment, and heat address type liquid crystal equipment, it is altogether contained in this invention. The liquid crystal equipment of this invention is widely applicable as a display in fields, such as a word processor, computer display, liquid crystal television, video camera, video tape recorder, electronic notebook, electronic calculator, car navigation equipment, large-sized display-board, and POS-terminal

machine, an input device with a touch panel, audio equipment, various gauge boards, a liquid crystal projector (projection mold display using liquid crystal equipment), a portable telephone, a wrist watch, wrist watch mold electronic equipment, and various measuring equipment. It can be advantageously used as displays, such as ambulance or vehicle equipment with which a severe working temperature range is demanded especially at the time of real use, aircraft equipment, and a portable telephone. Furthermore, the liquid crystal equipment of this invention is applicable to fields in addition to a display, such as for example, optical shutter equipment and polarization equipment.

[0028] The example of electronic equipment using the liquid crystal equipment of this invention as a display is shown in drawing 2 (a), (b), and (c).

[0029] Drawing 2 (a) is the perspective view having shown an example of a cellular phone. In drawing 2 (a), 200 shows the body of a cellular phone and 201 shows the liquid crystal display section which used the liquid crystal equipment of this invention.

[0030] Drawing 2 (b) is the perspective view having shown an example of pocket mold information processors, such as a word processor and a personal computer. In drawing 2 (b), 300 shows an information processor and the liquid crystal display section for which the input sections, such as a keyboard, and 303 used the information processing body for, and, as for 301, 302 used the liquid crystal equipment of this invention.

[0031] Drawing 2 (c) is the perspective view having shown an example of wrist watch mold electronic equipment. In drawing 2 (c), 400 shows the body of a clock and 401 shows the liquid crystal display section which used the liquid crystal equipment of this invention.

[0032] Since each electronic equipment shown in drawing 2 (a) - drawing 2 (c) is equipped with the liquid crystal display section which used either of the liquid crystal equipment of this invention, deformation of the substrate produced by the temperature change at the time of low temperature or an elevated temperature and generating of the air bubbles in a cel are controlled, and it becomes usable in a large temperature requirement.

[0033]

[Effect of the Invention] Since each coefficient of cubic expansion of the spacer which intervenes between one pair of substrates at least whose one side is flexibility, and a substrate connection member is within the limits of 3x10-4/degree-C - 1x10-3/degree C, deformation of the substrate produced by the temperature change at the time of low temperature or an elevated temperature and generating of the air bubbles in a cel are controlled, and the liquid crystal equipment of this invention becomes usable in a large temperature requirement.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the typical sectional view showing an example of the liquid crystal equipment of this invention.
[Drawing 2] (a), (b), and (c) are the perspective views showing the example of the electronic equipment which has the liquid crystal display section which used the liquid crystal equipment of this invention, respectively.
[Drawing 3] It is the typical sectional view showing an example of conventional liquid crystal equipment.
[Description of Notations]
10: Liquid crystal equipment
11 12: Film substrate
14: Substrate connection member
15: Spacer
16: Sealant
17: Common electrode
20: Optical layer
21 24: Orientation film
22: Segment electrode
25: Liquid crystal
26: Cel

[Translation done.]